

K. Filing Fees

The Notice discusses the requisite filing fees, and proposes that fees derived from the MDS schedule would be applicable. However, in adapting this schedule to the new service, the Commission has allowed potential inequities to creep in. For example, under the proposed rules, the applicant would need to submit a fee of \$155 per cell proposed, and the subsequent licensing fee is \$455 per 20 MHz channel per cell constructed. This could mean that to apply for a medium-sized market with 10 cells could cost \$1,550, and cost over \$200,000 to license (if the "per channel" fee is assessed separately for each cell). This would appear excessive, since the Commission's processing costs should not vary with the number of cell sites.

Video/Phone believes that the Commission should specifically develop filing fees for this new service that reflect the nature of the 28 GHz service and the actual processing costs associated with reviewing and processing the applications. Since the Commission proposes only to review in detail the winning application (Notice at para. 43), then the fee to accompany the initial filing of the application should reflect the initial processing costs, and should not depend on the number of cells or stations proposed in the application.^{23/} The Commission could then require the winning applicant, shortly after the lottery, to submit a second fee to cover the costs of

^{23/} Video/Phone believes that a fee of approximately \$500 per application would be reasonable.

reviewing and processing the application, and Video/Phone would anticipate that this second fee would be relatively substantial.^{24/} Finally, Video/Phone believes that a filing fee to accompany the notice of completion of construction is appropriate, but that the fee suggested in the Notice computed by arbitrarily assessing \$455 for 50 channels is excessive. Thus, a fee reflecting the Commission's final processing costs should also be developed. In short, to the extent that the Commission requires amendment of the statutory fee schedule for this new service, the Commission should seek the necessary Congressional changes, rather than attempting to "shoehorn" the 28 GHz service into the MDS fee schedule.

L. Discouraging Speculative Applications

The Notice recognizes that many of the potential benefits would be reduced or eliminated if the new service was needlessly delayed because the Commission's processing efforts were slowed by speculators and "application mills." Thus, the Commission has proposed a number of steps to minimize the risk of such delay, and Video/Phone applauds the Commission's efforts to "weed out" the non-sincere applicants that have emerged in many of the new services created by the Commission.

^{24/} Video/Phone believes that a fee in the neighborhood of \$10,000 would reasonably reflect the Commission's costs in reviewing the winning application to measure compliance with its Rules.

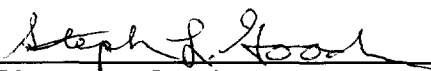
For example, the Notice incorporates numerous provisions intended to discourage filings by insincere applicants merely seeking to "win" a valuable government resource, rather than seeking a license in order to provide service to the public. Video/Phone shares the Commission's goal of eliminating these abuses, having observed first hand the problems and delays wrought by the "application mills" with respect to other services. Thus, Video/Phone supports the Commission's proposal to utilize a "letter perfect" standard, to prohibit interests in multiple applications in a territory, to impose strict financial showings, and to prohibit transfers prior to completion of construction. The Commission also proposes a "one-day filing window," and Video/Phone believes that such a requirement should help discourage the application mills. As a corollary to that requirement, Video/Phone also suggests that the Commission provide notice of the opening of a window relatively close to the date of notice. Video/Phone believes that two-months notice of a filing window being opened will give legitimate applicants an adequate period of time to prepare an application, particularly if, as Video/Phone suggests, the application need not reflect specific, leased sites for each of the transmitters.

IV. CONCLUSION

Video/Phone strongly supports the Commission's proposal to allocate spectrum and adopt service rules for the provision of a new service in the currently unused 28 GHz band. Video/Phone

believes that the new service has the potential to meet unserved demands of the marketplace. However, Video/Phone believes that the Commission should not attempt to limit the capabilities of the new service by "pigeon-holing" it as a cable television programming service, since the 28 GHz band can deliver much more. Video/Phone urges the Commission to move ahead quickly with the allocation and processing of applications, and believes that the prompt implementation of the 28 GHz service, as envisioned by Video/Phone, will well serve the public interest.

Respectfully submitted,
Video/Phone Systems, Inc.


Albert Halprin
Stephen L. Goodman
Halprin, Temple & Goodman
Suite 1020, East Tower
1301 K Street, N.W.
Washington, D.C. 20005
(202) 371-9100

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NEW MARKETS FOR LOCAL TRANSMISSION SYSTEMS:

**A BACKGROUND STUDY OF MARKET OPPORTUNITIES
FOR LOCAL WIRELESS BROADBAND SERVICE**

Prepared by MARTIN C. J. ELTON
On behalf of VIDEO/PHONE SYSTEMS INC.

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I. INTRODUCTION

This paper is the result of a preliminary study to identify market opportunities for Local Wireless Broadband Service (LWBS), a versatile new wireless service recently proposed to the FCC by Video/Phone Systems, Inc. The service can provide a broad combination of local, one-way and two-way, analog and digital transmission services. It is based on a new technology which is best described as a wireless broadband cellular technology. Salient characteristics are summarized in the following chapter.

Four broad categories of business service are discussed. Chapter Three addresses the market for general purpose local digital transmission – i.e., the local transport of digital signals between fixed points (one of which may be an interexchange carrier's point of presence), without regard to whether they represent voice, video, data, or some combination of them. Customers use vendors other than the local telephone company either because they offer a better price/performance ratio or because they want to avoid the risk of being reliant on a single transmission (or switching) system.

Chapter Four covers the two forms of corporate videoconferencing: two-way, which is almost entirely digital, and one-way, which is still primarily analog. LWBS is particularly well suited to meet the problems which still occur at the "local ends" of two-way

interesting possibilities for LWBS. In some circumstances, the relationship between LWBS and the telephone company could be one of partnership. Chapter Seven provides a brief discussion of the possibilities in the residential market.

II. KEY CHARACTERISTICS OF AN LWBS SYSTEM

This chapter offers a brief summary of characteristics of LWBS, limiting itself to those that are particularly salient to the study.

From the headend of an LWBS system, omnidirectional signals in the 27.5 to 29.5 GHz range are transmitted to an unlimited number of customer locations up to about six miles away. The signal can comprise many different analog and digital channels of a wide variety of bandwidths and bit-rates. Individual channels can be addressed, so that they are available only to a particular customer location; if greater security is needed, encryption can easily be provided.

Signals can also be transmitted from customer locations back to the headend. From there, incoming signals can be transferred to another network - for example, that of an interexchange carrier - or they can be retransmitted to another local site, thus providing point-to-point service.

By adopting a cellular approach, the service area can be expanded into a pattern of interconnected cells. By reducing the size of the cells, capacity can be increased.

The capacity of the system is large. It would be enough for 600 full-duplex 1.5 Mbps circuits (the capacity of a T1 carrier), if used entirely for that offering.

The antennas which must be installed on customers' premises are very small, so installation is quick and easy. Wiring from the antenna can enter through any window, which minimizes the need for additional inside wiring. A clear line-of-sight is needed to the transmitter at the headend but, since the antennas are so small, it will often be easy to use reflectors or repeaters to get around obstacles. And, in engineering tests, the technology has been shown to produce exceptionally low bit error rates across the full range of atmospheric conditions.

From a marketing perspective, the following implications are of particular importance:

- Costs of installation at a customer's premises are independent of the customer's location and are incurred only when the customer is obtained. This is totally different from situation for wired systems and is of massive importance in minimizing risk
- Installation costs at a customer's location are low, so high volumes will not be needed to ensure viability and customers will be more

III. GENERAL PURPOSE LOCAL TRANSMISSION

Competitive Provision of Local Digital Services

A respected commentator has recently referred to local exchange competition as "The \$70 billion opportunity."¹ While the exact size of the market which will be open to competition may be a matter of speculation, it is clear that it is enormous. Until now, competitors to the local telephone company have been restricted largely to providing bypass connections to interexchange carriers' points of presence and private circuits interconnecting users' facilities. What has changed is that state regulators are embarking upon a complete reversal of policy: promotion of local exchange competition is to replace protection of the local exchange carrier. The change is being supported by policies on unbundling and collocation.

The term *revolution* has been decidedly overused in connection with telecommunications and computer technologies. It would not, however, appear exaggerated on this occasion. Describing an order adopted by the New York State Public Service Commission on November 25, 1991, a front-page article in the New York Times commented,

"The New York rules are the first of their kind, but they come amid an accelerating movement by state and Federal regulators to sweep away barriers to competition in the \$100 billion local telephone business."

Significantly, the article added,

"But the changes could also mean greater complexity and confusion. Under the new rules, business customers will have the right to send their calls over telephone lines owned by one company, route calls over the switching network of another and retain an emergency backup service from a third."²

Regulators in California, Illinois, and Massachusetts, not to mention the FCC, are also moving towards breaking the monopoly of the local telephone company.

¹ Dr. Jerome Lucas, announcement for a TeleStrategies conference on November 19, 1991.

² New York Times, November 26, 1991.

Contrary to the prevailing views at the time of the AT&T Divestiture, large business customers are concerned with much more than price. Quality of service - responsiveness and reliability - turned out to be the primary consideration for many. (During the last two to three years, transmission diversity has become a prominent new concern: users do not want to put all their eggs in one transmission basket. This subject will be addressed in the next section.)

How well would LWBS be placed in this particular market? Its major advantages would include:

- rapid start-up, since it will not need to install cable
- geographical flexibility, since proximity to existing trunks and-or switches will be irrelevant
- selectivity in choosing where it will compete; for example it could choose to concentrate on areas not (or not yet) served by companies such as Teleport and Metropolitan Fiber Systems
- lower installation costs, which would permit lower volume customers to be profitable.

The cost structure of companies that must install optical fiber makes it necessary for them to concentrate on high volume customers in dense areas of demand. This will be unnecessary for LWBS. As a result, it can, if it so chooses, avoid head-to-head competition with all existing or new alternative access providers.

Security need not be a problem, since encryption equipment can easily be employed at customers' premises and the headend. Although price matters more in today's economic climate than it did in the past, the market is likely to remain quality sensitive. As a result, LWBS will have to establish a reputation for service and reliability. This should be entirely feasible: the technology is highly reliable; it also provides a distinct competitive advantage in its low lead time for installation or change of service. A possible problem may be customers' preferences to minimize multi-stop shopping. However, this problem is unlikely to be significant, since the market will adapt to increased competition with further use of

systems integrators and-or outsourcing; alliances between new service suppliers and interexchange carriers would also alleviate the problem.

Redundancy

The previous section dealt with situations in which the local telephone company may not be able to provide as good value for money as a competitor. But even when it can, customers would be unwise to put all their eggs in one basket.

The dramatic impacts of recent outages - the last being AT&T's mishap in September 1991, which blocked 5.5 million calls over a period of nearly seven hours - has made business users much more conscious of their vulnerability to the loss of telecommunications service. The best way of achieving reliability is through redundancy.

Redundancy is of various kinds. Carrier redundancy protects against a problem affecting one carrier's network, but very often carriers use the same ducts. Route redundancy protects against a duct being severed. But neither provides protection if wiring in a building's only riser is damaged; authorities also recommend redundancy in risers and in the entry of cables into a building. Clearly, central office redundancy is another need.

LWBS has the opportunity to take advantage of this well-founded and rising concern. Its service can simultaneously provide carrier, route, and entry redundancy. It can do so, moreover, at a relatively low cost and with a very short response time. While local exchange carriers have recently addressed this need with offerings which serve business subscribers with separate routes to two separate central offices, there are problems with this approach. First, some local exchange carriers charge extra for the offering; customers do not see why they should be obliged to pay the telephone company more for reliability. Second, the public switched telephone network is rapidly increasing its reliance on software. Serious outages have been caused by bugs in newly installed computer programs for Signaling System Number 7 (SS7):

*Some have even raised concerns that today's SS7 network architecture is questionable for today's network requirements, and that it might be

inadequate for the applications to come 10 years hence.

*Network engineers found the SS7 outages that Bell Atlantic and Pacific Telesis suffered in June and July as awesome as they were frightening.

*A software glitch when triggered in one STP, resulted in a series of data signals that instructed other switches in the network to react as if they were overloaded with calling traffic. The network behaved as if it were seized by massive gridlock and did not allow any calls to be completed.

*In Bell Atlantic's situation, the error occurred in a ... central office in Baltimore. But the false signals caused the switching systems throughout Maryland and into Virginia, West Virginia and Washington, D.C. to fall like

IV. VIDEOCONFERENCING

Two-way Videoconferencing

In 1990, two-way videoconferencing had about a 35% share of the billion dollar

conferencing units (MCUs) which entered the market within the last two years or so; they allow more than two sites to participate fully in the same videoconference.

Three portions of the market can be expected to show particularly strong growth during the next ten years. The first, noted above, is intercorporate use. The second is use by smaller business users, as well as state and local governments, who will now find it affordable. Thirdly, there is short-distance use. On common sense grounds, one would expect there to be substantial demand for videoconferencing over short distances - e.g.,

~~between two offices in the same city or within the suburbs. One reason is that most~~

One year's experience

possibility lies in local applications: training government employees or day care staff in a major city, for example. Another possibility is that there will be a growth in the demand for the "interactive" variety of one-way videoconferencing. LWBS can provide a single transmission system for both modalities, replacing today's clumsy and complicating use of the telephone network as a complement to a communications satellite when return audio is needed.

V. VIDEO COMMUNICATIONS: OTHER EARLY MARKET SERVICES

Fairly closely related to videoconferencing are a variety of other more specialized or more tentative applications, which also merit comment.

Picture-telephony

AT&T's recent announcement of a residential picture telephone, for use over the regular public switched telephone network and costing about \$1500 per instrument, is a massive vote of confidence in the picture-telephone market. Clearly many other manufacturers, too, expect picture telephones to take off in the near future: at least 20 are being readied for the U.S. market, a further 15 or so for overseas markets.

Picture-telephony is distinguished from videoconferencing by the fact that a picture telephone is for use by one person at a time, rather than by a group. Its picture quality is

unattended service points; the associated equipment might appear like an automatic teller machine with a picture telephone.

While AT&T's new technology is a remarkable achievement, it remains to be seen whether its visual resolution and motion-handling capability will be acceptable. Although it is unlikely that there will be a market for it among business customers (except for telemarketing, once there is sufficient residential penetration), its announcement has already stimulated corporate customers' interest in the medium; it is quite likely that the market launch will stimulate the sale to business users of picture telephones using digital transmission (at 56 or 64 kbps). LWBS would be well placed to meet these users' needs for short-haul transmission, if the market opens up before switched 56/64 kbps networks are widespread.

Health Care

Extensive broadband field trials of telemedicine systems in the 1970's demonstrated that, in large measure for institutional reasons, implementation problems are considerable. Nevertheless, no significant barriers were encountered in connection with acceptance by patients. It appears that, using optical fiber, the RBOCs are seriously exploring telemedicine systems which interconnect urban area hospitals and associated facilities. Any success which they encounter is likely to create demand elsewhere which, in the near term, LWBS would be able to meet sooner than the RBOCs in most instances.

Criminal Justice

The only success encountered by AT&T's original Picturephone™ was in a field trial set in the criminal justice system of Phoenix, Arizona, in the early 1970's. There have been a number of successful projects using videoconferencing systems since then. Currently at least ten such systems are in use across the country. Associated tasks include arraignments, the formal filing of complaints when incidents are first reported at police stations, and taking evidence from probation officers. Since those associated with criminal justice - courts, police stations, district attorneys, public defenders, prisons, probation officers, and so on - are usually widely dispersed in urban areas, and since procedural delays can cause major problems, this niche videoconferencing market is likely to prosper. LWBS is well matched

to the demand.

Education

A wide variety of telecommunication systems are used in education. Different media and formats suit different situations. For present purposes, the use of two-way videoconferencing technology is of the most interest. It is increasing.⁸

A good example arises in the teaching of advanced engineering and science courses to employees of high-technology companies at their places of work. In high value-added applications it is easier to justify the combination of a more costly two-way system and a special relationship with a respected local school, which allows for telecommunications to be combined with in-person communication at certain points in the semester. This approach is highly flexible and the model of choice when an emphasis is placed on personal relationships between students and teachers. In other cases, it may suffice to rely on a one-way system programmed by a distant school.

Clearly LWBS is well placed to support educational applications which employ two-way videoconferencing systems.

Telecommuting

Estimates of the extent of telecommuting vary widely, but there is general agreement that it is growing fast. To take one example, NTIA estimates that, "Some 3.6 million employees with full-time, commutable jobs worked at home at least one day per week in 1990, up 21% from 1989."⁹ With strong support from all levels of government, increasing understanding by employers about how to implement a successful telecommuting program, and growing realization of the benefits to the individuals and firms involved, continuing rapid growth seems very likely.

From LWBS's perspective, the drawback is that the telecommunications requirements of today's telecommuters are generally modest. According to a report by LINK Resources,

⁸ The NTIA Infrastructure Report: Telecommunications in the Age of Information, U.S. Dept. of Commerce, 1991.

⁹ Ibid.

fewer than one-sixth of telecommuting households own modems and well below 10% own facsimile equipment. ¹⁰ If telecommuting continues its rapid development, there is likely to be a state change at some point; it is possible that new telecommunications needs will then arise. Possibilities include two-way visual services and Business Television for telecommuters. Further downstream, there may be a need for connection to hypermedia databases. For the time being, however, prospects are not exciting.

¹⁰ "Telecommuting Makes Good Sense - Dollars and Cents, Too," ESU Update, Vol. 4, No. 10, Oct. 1991, LINK Resources.

VI. MOBILE SERVICES

The mobile services market is expanding very rapidly. The principal services which rely on terrestrial wireless transmission are:

<u>Service</u>	Estimated Worldwide Market ¹¹	
	<u>1990</u>	<u>1995</u>
Cellular telephone	\$7.2 bn	\$18.8 bn
Specialized mobile radio	\$4.4 bn	\$3.9 bn
Personal communication networks	—	\$0.6 bn
Paging	\$2.5 bn	\$3.7 bn

The following near-term developments can be anticipated:

- cellular telephones - conversion from analog to digital, thus increasing capacity and improving quality
- specialized mobile radio - conversion of these private, analog services now used by taxis etc. to public, digital services competing with cellular telephones for voice and data traffic (e.g., Fleet Call and Ram Mobile Data)
- personal communication networks - start of operational service following current trials
- paging - use of these services for transmission of data to portable personal computers.

There are two opportunities of note for LWBS.

¹¹ Source: Gartner Group, as cited by Upside, December 1991. Figures rounded to \$0.1 bn.

Interconnection of Cells

Personal communication networks and specialized mobile radio will need backbones to interconnect their multiple cells (hence the interest of the cable television industry in the former.) While telephone and cable companies offering PCN service in their local areas will use their in-place infrastructure for this purpose, they will have competitors who would likely prefer to obtain backbone service from an independent provider. LWBS would be the natural source to which to turn.

Displaced Users

A recent proposal by the FCC to allow those wanting spectrum space to purchase it from the public emergency services and utilities who are current license holders has encountered noisy opposition. However the matter is resolved, it provides a clear example of enormous pent-up demand for the radio spectrum. There will be continuing pressure for the implementation of new technologies which will allow radio waves to be used more efficiently and for associated reallocation of the spectrum. Regulators will seek win-win solutions, in which those giving up existing rights will be paid more than the cost of converting to a more efficient alternative.

LWBS is very well placed to provide the efficient alternative for the portion of the traffic which is between fixed sites. Further study would be necessary to determine the significance of this potential.

VII. RESIDENTIAL SERVICES

One of the most attractive features of LWBS is its plasticity: it can be remolded at minimal cost since it can operate in either or both of analog and digital modes and can serve customers without the need to "pass" them. Moreover, capacity can be increased by reducing cell size, so existing customers need not be dropped when new services are added. So the question arises whether there will be attractive residential markets to be added to earlier business markets. This is a distinct possibility, best discussed in the context of video dial-tone.

Video Dial-tone

It has been suggested that local exchange carriers' best route into providing video dial-tone would be via asymmetric digital subscriber line (ADSL) technology. (ADSL will soon be the subject of a field trial. Bell Atlantic and AT&T are involved.) At an average cost of \$400 to \$600 per line, this allows an existing copper pair, without repeaters, to provide a customer with a combination of one-way 1.5 Mbps service and two-way telephone service. As Dr. Jerry Lucas has pointed out, the make or break issue may well be whether customers will accept the VCR quality television which compression down to 1.5 Mbps provides.¹² The cable industry will probably be competing using 5 Mbps service, which will certainly be acceptable.

If telephone companies are allowed to provide video dial-tone and accept the challenge, various interesting possibilities will arise, among them:

- telephone companies will want to use LWBS, maybe in combination with ADSL, so as to achieve critical mass rapidly and- or so as to extend service beyond the range that can be served by ADSL
- they will want to conduct market trials using ADSL
- the service will get bogged down because of resistance to the

¹² Lucas, J., "The FCC Blesses Video Dial Tone for Telcos," TeleStrategies Insight, November 1991.